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2020-06

Metsä-Simola , N , Moustgaard , H & Martikainen , P 2020 , ' Time patterns of external and alcohol-related mortality after marital and non-marital separation : the contribution of psychiatric morbidity ' , Journal of Epidemiology & Community Health , vol. 74 , no. 6 , pp. 510-518 . https://doi.org/10.1136/jech-2019-213555

http://hdl.handle.net/10138/327181
https://doi.org/10.1136/jech-2019-213555

acceptedVersion

# Time patterns of external and alcohol-related mortality after marital and non-marital separation: The contribution of psychiatric morbidity

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**Key words:** mortality, mental health, marital status, suicide, longitudinal studies

**Word count:** 3385

**Funding**

This work was supported by the Academy of Finland [grant numbers 1308247 and 1294861] and NORDFORSK project WELLIFE.

**Conflict of Interest**

None declared.

**What is already known**

External and alcohol-related mortality is elevated after marital separation, but it is unclear how persistent the excess is and whether it also exists for non-marital union separation. While separation is bi-directionally associated with poor mental health, the contribution of poor mental health before, during and after the separation process on post-separation excess mortality is not known.

**What this study adds**

External and alcohol-related excess mortality is larger following marital than non-marital separation and is most pronounced immediately after separation, particularly among men. Psychiatric morbidity - particularly psychiatric morbidity before separation among women and during and after separation among men - clearly explains post-separation excess suicide mortality, suggesting that mental healthcare professionals should pay close attention to relationship dynamics.

**Abstract**

Background. External and alcohol-related mortality is elevated post-separation, but the role of poor mental health in explaining this excess is unclear. We assess post-separation excess mortality by union type and over time since separation, and examine how psychiatric morbidity present already before separation, during the separation process, and after separation attenuate this excess.

Methods. Using individual-level register-data from 1995-2012, we followed 311,751 Finns in long-term unions. Psychiatric morbidity was identified from dates of prescription medication purchases and hospital admissions, separations from dates of moving out of joint households, and mortality from the Death Register. Cox regression was used to analyze post-separation mortality controlling for psychiatric morbidity before, during and after separation.

Results. External and alcohol-related excess mortality is most pronounced immediately after separation, particularly among men, and is much larger following marital than non-marital separation. After socio-demographic factors are adjusted for, further adjustment for psychiatric morbidity attenuates the excess by about 25%. Psychiatric morbidity poorly explains alcohol-related post-separation excess mortality, but for suicide mortality, adjustment for psychiatric morbidity reduces the excess by about 40% among men and 50% among women. Among women this is largely due to psychiatric morbidity present already before separation, whereas among men the attenuation is also due to psychiatric morbidity during the separation process and after it.

Conclusion. Separation may exacerbate the problems of people already in poor mental health, and relationship dynamics should thus be considered during treatment. Particularly among men separation is a risk factor for suicide even without pre-existing mental health problems.

Keywords: mortality, separation, marriage, cohabitation, psychiatric morbidity, suicide, mental health, divorce

## Introduction

Various socioeconomic and family characteristics are associated with mortality, and studies have consistently shown that divorce predicts mortality in various social settings.[1–3] Poor mental health is also associated with mortality[4] , but the extent to which poor mental health explains post-divorce excess mortality is unclear. While divorce has an effect on mental health, poor mental health also increases the probability of divorce[5–12], and excess mortality may thus result from poor mental health evident already before divorce or changes in mental health related to divorce.

We focus on mortality attributable to external and alcohol-related causes of death in mid-life. Post-divorce excess mortality is highest for these causes of death, particularly among men.[13–16] We are aware of only one study that has examined the time patterns of this excess.[15] It showed that in Finland excess mortality due to external and alcohol-related causes of death is pronounced immediately after divorce, with a reduction thereafter. We are not aware of any previous studies assessing the time patterns of excess mortality following non-marital separation, although non-marital unions are highly common and generally less stable than marriages,[17–19] and thus an increasing proportion of separations are non-marital.

The elevated post-separation mortality may partly follow clinically significant symptoms of poor mental health present already *before* separation. For example, among married Finnish couples, the risk of separation remained elevated more than two years after initiation of psychotropic medication use or psychiatric hospital care of either spouse.[9] On the other hand, deterioration of mental health *at the time* of separation could increase post-divorce mortality since psychotropic medication prevalence has been shown to clearly increase at the time of marital divorce and separation from long-term non-marital cohabitation.[8,20] To our knowledge, only one prospective study based on the Health and Retirement study (HRS) in the US has examined how the emergence of depression predicts post-divorce mortality.[21] It showed that depression that emerged at the time of marital divorce predicted increased mortality, whereas depression that was already present before divorce did not have a similar effect.

The HRS sample only includes individuals older than 50, is based on self-reported symptoms, and examines all-cause mortality.[22] Our study combines information from various administrative registers to examine patterns of external and alcohol-related mortality after marital and non-marital separation, and the contribution of poor mental health - measured as purchases of psychotropic medication and hospital care with psychiatric diagnosis - in a population sample of working-age Finns. We aim to compare whether excess mortality is higher following marital than non-marital separation, whether it declines over time since the separation, and whether adjusting for psychiatric morbidity before, during, and after the separation process reduces the excess. In addition to all external and alcohol-related causes of deaths, we examine time patterns of excess alcohol-related mortality and excess suicide mortality separately.

**Data and methods**

*Study sample*

The study uses an 11% random sample of the Finnish population aged 25-64 from years 1995-2012, with an oversample of deceased individuals added to cover 80% of all deaths. These data from Statistics Finland include exact dates of entering non-marital and marital unions, exact dates of separation, annual socio-economic and household information, and exact dates and causes of death. Statistics Finland has further linked these data to information on medication purchases from the administrative register held by the Social Insurance Institution, and information on hospitalizations from the administrative register of National Institute of Health and Welfare using unique personal identification codes assigned to all permanent residents, (the Ethics Committee of Statistics Finland's permission TK-53-339-13). Because of concern for individual anonymity, the permission to use the data for research purposes only covered 80% of deaths that took place between 1987 and 2012, and 11% of the living population from the same years.

We included individuals that lived with the same partner for at least three consecutive years during 1995-2012 and refer to these as long-term unions. If an individual had more than one long-term union during the period, we focused on the latest union. The three-year threshold was chosen because short-term cohabitation is quite common among younger individuals[17], and separation from these short-term

unions has little effect on the levels of psychotropic medication use[20]. In contrast, longer non-marital unions are thought to resemble marital unions, and accordingly the changes in psychotropic medication prevalence are quite similar before and after formal divorce and separation from long-term non-marital unions.[8,20] Furthermore, we wanted to capture pre-separation psychiatric morbidity comprehensively over a relatively long period - up to three years before separation - and for shorter unions that would have reflected morbidity before even entering the union and thus not yet at risk of separation.

We excluded individuals whose latest long-term union ended in bereavement, after which our sample included 311,751 individuals, of whom 66,914 separated. For them, mortality follow-up began at the date of separation. If the exact date of separation was not available (3356 individuals), the middle point of the year during which the separation took place was chosen as the first day of follow-up. Of the separations, 39,063 were marital and 27,851 non-marital. While non-marital unions dissolve more often than marital unions, most of these separations take place within the first two years after union formation[17], whereas we only included individuals in unions that have lasted for at least three years. For those 244,837 individuals not separating, follow-up began after the union had lasted for at least three years.

*Variables*

For the purpose of this paper we defined psychiatric morbidity as psychotropic medication purchases and psychiatric hospitalizations (see Table 1 for full definition). From the dates of medication purchases and the dates of entry to and exit from hospital, spells of psychiatric morbidity were constructed. An individual was considered to experience psychiatric morbidity starting from the date psychotropic drugs were purchased. In Finland, physicians prescribe all psychotropic drugs, and all residents are entitled to reimbursement for medication expenses for products to be used within the next three months.[23] Thus individuals on continuous medication were expected to make drug purchases once within three months on average. However, when coming off medication, slow tapering off is generally recommended, and recovery was thus assumed to take place when no

purchases were made within 6 months since the last purchase. For psychiatric hospitalizations, we defined psychiatric morbidity to begin on the date of entry into a hospital, and end 6 months after exit.

We measured psychiatric morbidity during three separate time periods. First, we examined whether an individual had at least one spell of psychiatric morbidity beginning more than two years prior to the mortality follow-up. For the separated, this means psychiatric morbidity more than two years before separation, and we refer to this binary variable as *psychiatric morbidity before separation*. However, for those not experiencing separation, mortality follow-up begins after three years in a union (but not before 1998). Second, we examined if an individual had a spell of psychiatric morbidity during the two years immediately before the beginning of mortality follow-up. This binary variable measures *psychiatric morbidity during the separation process*. Finally, we examined psychiatric morbidity during the mortality follow-up. This time-varying variable measures *psychiatric morbidity after separation* and takes on the value 1 during the spells of morbidity and 0 between them.

Because psychiatric morbidity was measured three years before the mortality follow-up, and information on psychiatric morbidity was only available from 1995 onwards, the mortality follow-up began on Jan 1$^{st}$ 1998 the earliest. We focused on external and alcohol-related causes of death (see Table 1 for full definition), and observed 12,277 deaths attributable to these causes (51.4% of all deaths among those separating and 20.9% among those not).

During the follow-up, we measured socio-demographic covariates annually. Education was based on highest educational qualification (tertiary, intermediate, and basic or less), social class on current occupation, or previous occupation if currently economically inactive (upper non-manual, lower non-manual, manual and other). Annual income included all individual-level taxable income (salaries, capital income, and income transfers) and was annually classified into quintiles. Main activity was based on occupational activity during the last 12 months (employed, unemployed, retired (mostly due to disability), and other (e.g. housewives and students)). For housing tenure, owner-occupiers were separated from others. We also controlled for coresident under-aged children (yes or no), whether in first union or not (information on all previous marriages was available from year 1972 and

information on previous cohabitations from year 1987 onwards), and union duration (less than 10 years, 10-14 years, and 15+ years).

*Statistical methods*

We used Cox proportional hazards regression with censoring occurring at the end of follow-up, at emigration, or death from a cause different from the ones studied. To study the time patterns of post-separation excess mortality, time since the separation was split into three categories: 0 to 2 years, 2 to 7 years, and 7 years or more. Within these time intervals, the hazard rates of the separated were approximately proportional to the hazard rates of the reference category. However, for clarity we also show the hazard ratios (HR) over the full study period to give readers an overview of the changes that follow adjustment for psychiatric morbidity before, during, and after the separation process. A similar approach has been used previously to study time patterns of post-divorce excess mortality by cause of death.[15]

**Results**

Psychiatric morbidity was clearly more common among separating individuals than others (Table 1, Supplementary Table 1). Already three to two years before separation, 13.4% of married men and 17.7% of married women either purchased psychotropic medication or received hospital care. These figures increased to 22.0% and 28.2%, respectively, immediately before separation. After marital separation 15.7% of men and 20.9% of women experienced psychiatric morbidity. The percentages were slightly lower among those separating from non-marital unions. The proportion experiencing psychiatric morbidity was quite similar in continuous marital and non-marital unions (less than 10% among men, less than 15% among women).

After marital separation, age-adjusted mortality was four-fold among men and three-fold among women compared to those whose union continued (Figure 1, Supplementary Table 2). Adjustment for socio-demographic covariates attenuated the excess mortality by nearly 50%, but further adjustment for psychiatric morbidity attenuated the excess only moderately, and this reduction was almost

complete when only adjusting for psychiatric morbidity present already three to two years before follow-up.

The excess mortality was much smaller after non-marital separation, but the reduction when adjusting for socio-demographic covariates and psychiatric morbidity was similar for both marital and non-marital unions. The age-adjusted risk was 2.5-fold among men and almost two-fold among women separating from non-marital unions, and after adjustments the excess was no longer evident among women.

The excess mortality was most pronounced immediately after marital separation, particularly among men (Figure 2, Supplementary Table 3). Within the two years immediately after marital separation, age-adjusted mortality was nearly eight-fold among men and five-fold among women, whereas two to seven years since the separation mortality was less than four-fold among men and three-fold among women. Since then no changes could be observed. After non-marital separation there was no clear decrease in mortality by time since separation. The attenuation after adjusting for psychiatric morbidity and other socio-demographic covariates was quite similar regardless of time since separation. Supplementary analyses showed that restricting the sample to unions of at least five years in duration had little effect on the time patterns of excess mortality, except that immediately after separation excess mortality was somewhat higher, particularly among women (Supplementary Table 4). The difference in post-separation excess mortality between first unions and unions of higher order was very similar to the difference between marital and non-marital unions (Supplementary Figures 1 & 2, Supplementary Table 5). Excess mortality was higher after separation from first unions, and particularly so during the two years immediately after separation.

When comparing post-separation excess mortality among those aged 25 to 44 to those aged 45 to 64, the excess was slightly higher among the younger group when only adjusting for age, but very similar after adjustment for all covariates (Supplementary Figures 3 & 4, Supplementary Table 5).

When examining all marital and non-marital unions, age-adjusted alcohol-related mortality was higher among separated men than separated women, whereas the age-adjusted risks for suicide were quite similar among separated men and separated women (Figure 3, Supplementary Table 3).

Adjustment for socio-demographic covariates clearly reduced alcohol-related excess mortality, whereas adjustment for psychiatric morbidity clearly attenuated suicide risk. Interestingly, among separated women psychiatric morbidity present already three to two years before separation largely explained this attenuation, whereas among men further adjustments for psychiatric morbidity two years before separation and during follow-up had a stronger additional effect.

Although the suicide risk was six-fold immediately after separation among men and five-fold among women, after adjustments for socio-demographic covariates and psychiatric morbidity, this excess suicide risk almost disappeared when time passed (Figure 4, Supplementary Table 3). For men the reduction in excess suicide risk was steepest immediately after separation, whereas among separated women the decline continued for a longer time. Among separated men excess alcohol-related mortality also showed a steep decline immediately after separation, with socio-demographic covariates explaining a large part of the excess. Psychiatric morbidity only had a small effect, which became negligible seven years since the separation.

**Discussion**

*Excess mortality by union type and time since separation*

Excess mortality attributable to external and alcohol-related causes of death is much larger following marital than non-marital separation.. Previous research on excess mortality after non-marital separation is scarce, although the number of non-marital unions has increased both in Europe and the US, with these unions being less stable than marriages.[18,19,24] Excess mortality is very high immediately after marital separation, particularly among men, with a decline thereafter, corroborating previous findings on the time patterns of post-divorce excess mortality.[15] However, after non-marital separation the excess changes little in time. Working-aged cohabiters have higher mortality compared to married individuals,[25] which may partly explain why the relative effect of non-marital separation on mortality is smaller. However, the effects of separation from a non-marital union may indeed be weaker than the effects of marital separation. Although we are not aware of previous studies that examine time patterns of post-separation mortality by union type, studies from the UK and Canada have shown that separation from non-marital cohabitation has less effect on mental health than marital

divorce.[5,24,26] In addition, the prevalence of psychotropic medication use hardly changes at the time of separation from short-term non-marital cohabitation, while the changes in prevalence are quite similar before and after separation from long-term non-marital unions and marital divorce.[8,20]

It has been suggested that the detrimental effect of marital separation should be higher, because the level of commitment and joint investments is higher in marital unions,[24,27] which is consistent with the observed mortality time patterns. In Finland most first unions start as non-marital cohabitations, and most of the unions that do not dissolve within five years, turn into marriages.[17] Previous research among working-age Finns has shown that in long-term unions of at least ten years, psychotropic medication use is uncommon in all union types, [8,20] suggesting that long-term commitment is important for mental health. In this study the post-separation excess mortality was also higher after separation from first unions, and the greater stability of first unions as compared to later unions may also be an indicator of stronger commitment. The importance of commitment is further supported by the somewhat higher excess mortality immediately after separation from unions of at least five years in duration compared to separation from unions that have lasted for at least three years.

*Excess mortality for suicides and alcohol-related causes after separation*

Poor mental health before separation clearly explains the excess suicide mortality after separation. It seems that individuals in poor mental health not only have a higher risk of separation, but also a higher risk of suicide thereafter, and that these associations are not explained by socio-economic disadvantage.

While among women adjustment for poor mental health two to three years before separation largely attenuated the post-separation excess suicide mortality, among men also poor mental health during and after separation attenuate excess mortality considerably. While among both Finnish men and women the prevalence of psychotropic medication use clearly increases before divorce and separation from long-term non-marital unions,[8,20] these changes in mental health during the separation process seem to be more important for the post-separation suicide risk of men. Among men the suicide risk is also particularly high immediately after separation, whereas among women the decline in suicide risk continues for a longer time, suggesting that men may be more prone to commit suicide as an

immediate reaction to the psychological strain of separation. This supports the findings based on the HRS that depression emerging at the time of marital divorce predicts all-cause mortality.[21]

While poor mental health clearly explains suicide mortality following separation, adjustment for socio-demographic covariates had a larger effect on alcohol-related excess mortality. Risky behaviors such as alcohol abuse are thought to reflect underlying psychological distress[28], and social and economic resources may shape the way in which symptoms of psychological distress are manifested. Men have been suggested to express psychological distress with behavioral changes more often than women, and accordingly the excess mortality attributable to alcohol-related causes of death is higher among separated men than separated women, particularly immediately after separation. It thus seems that men are more vulnerable than women to the psychological strain associated with separation.

*Strengths and limitations*

Comprehensive Finnish administrative registers gave a unique opportunity to assess the time patterns of post-separation mortality. In addition to the dates and causes of death, we had information on the exact dates of both marital and non-marital separations. Although some previous studies have used information on non-marital separations[29], we are not aware of other studies assessing the time patterns of post-separation mortality by union type. However, our definition of non-marital cohabitation – and thus non-marital separation – is entirely based on registers. Individuals living in the same dwelling with a person of different gender, who is not their married spouse or sibling, and with an age difference not exceeding 15 years are counted as cohabiters. The definition may include living arrangements that people themselves do not view as cohabiting unions, and it may exclude others who would see themselves as cohabiters. Nevertheless, the register-based definition of cohabitation has previously resulted in similar prevalence of non-marital cohabitation as survey samples in Finland.[30]

Most studies assessing changes in mental health at the time of separation have focused on milder symptoms of psychological distress and relied on self-reports[5,7,10,31–37], but our measure of psychiatric morbidity is based on clinical evaluation. While the measure is objective, it only captures treated individuals. It is common for individuals with mental disorders not to receive treatment, while at the same time people without a psychiatric diagnosis use psychotropic medications.[38–40] In the registers

we had no information on the diagnoses for the purchased drugs, and psychotropic drugs may be used for other than psychiatric indications, although less so in working-age[39]. Yet, at the population level, the prevalence trajectories of psychotropic medication use before and after divorce have been quite similar to the individual-level trajectories of psychological distress,[5,8,11] suggesting that changes in psychotropic medication use correctly estimate underlying changes in psychological distress. However, it seems probable that psychological symptoms increase mortality risk particularly when left untreated, highlighting the need for further research on the topic. Overall, the associations between psychiatric morbidity, separation and mortality are complex, making causal statements difficult. Unobserved factors such as personality traits may simultaneously affect the risks of separation, psychiatric morbidity, and mortality. We stress the need for future studies to more precisely quantify the contribution of psychiatric morbidity on post-separation excess mortality.

**Conclusions**

External and alcohol-related excess mortality is most pronounced immediately after separation, particularly among men, and is much larger following marital than non-marital separation. Psychiatric morbidity poorly explains alcohol-related post-separation excess mortality, but for suicide mortality, adjustment for psychiatric morbidity clearly reduces the excess. Mental healthcare should thus focus on couple-level dynamics to support union stability among patients and to prevent adverse outcomes after separation. Particularly among men, psychiatric morbidity during the separation process and after separation also explains excess suicide mortality, and separation should thus be noticed as a potential risk factor of suicide even without pre-existing mental health problems. The high alcohol-related excess mortality after separation highlights the need to prevent alcohol use as a coping strategy.

**Competing interests:** None declared.

**Table 1. Characteristics[1] of the study cohort, Finns aged 25 to 64**

| | | | Psychiatric morbidity[2] | | | External and alcohol-related causes of death[3] | Suicides[3] | Alcohol-related causes of death[3] |
|---|---|---|---|---|---|---|---|---|
| | *N*[1] | *%* | *Before separation*[4], *%* | *During separation*[5], *%* | *After separation*[6], *%* | *Deaths / 100 000 person years* | *Deaths / 100 000 person years* | *Deaths / 100 000 person years* |
| **MEN** | | | | | | | | |
| **Total** | 164,760 | 100.0 | 7.0 | 11.1 | 10.8 | 148.8 | 29.4 | 97.9 |
| Continuous | 130,490 | 77.9 | 5.5 | 8.5 | 9.6 | 108.7 | 20.2 | 65.9 |
| Separated | 34,270 | 22.2 | 12.5 | 20.3 | 15.0 | 389.3 | 66.2 | 287.5 |
| **Union type** | | | | | | | | |
| *Marital* | 129,503 | 100.0 | 6.8 | 10.7 | 10.8 | 131.0 | 26.5 | 84.1 |
| Continuous | 109,820 | 83.7 | 5.5 | 8.6 | 9.8 | 102.0 | 20.9 | 63.5 |
| Separated | 19,683 | 16.3 | 13.4 | 22.0 | 15.7 | 383.0 | 75.5 | 262.1 |
| *Non-marital* | 35,257 | 100.0 | 7.9 | 12.2 | 10.8 | 219.1 | 40.6 | 150.9 |
| Continuous | 20,670 | 57.5 | 5.4 | 8.0 | 8.3 | 143.0 | 26.6 | 97.2 |
| Separated | 14,587 | 42.5 | 11.3 | 18.0 | 14.2 | 398.0 | 73.8 | 277.7 |
| **Number of deaths[1]** | | | | | | 9294 | 1948 | 5909 |
| **WOMEN** | | | | | | | | |
| **Total** | 146,991 | 100.0 | 10.8 | 16.7 | 15.6 | 46.4 | 10.4 | 27.5 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Continuous | 114,347 | 76.7 | 8.8 | 13.6 | 14.1 | 37.2 | 6.7 | 22.2 |
| Separated | 32,644 | 23.3 | 17.3 | 26.8 | 20.5 | 98.6 | 21.2 | 57.4 |
| **Union type** | | | | | | | | |
| *Marital* | 116,303 | 100.0 | 10.3 | 16.2 | 15.6 | 39.4 | 9.2 | 22.1 |
| Continuous | 96,923 | 82.4 | 8.7 | 13.7 | 14.4 | 33.2 | 7.1 | 18.8 |
| Separated | 19,380 | 17.6 | 17.7 | 28.2 | 20.9 | 89.0 | 26.1 | 48.8 |
| *Non-marital* | 30,688 | 100.0 | 12.6 | 18.3 | 15.9 | 76.2 | 15.5 | 50.4 |
| Continuous | 17,424 | 55.7 | 9.4 | 13.2 | 12.6 | 59.2 | 10.4 | 41.2 |
| Separated | 13,264 | 44.3 | 16.6 | 24.8 | 19.9 | 113.3 | 26.5 | 70.4 |
| **Number of deaths**[1] | | | | | | 2983 | 672 | 1714 |

[1] N is unweighted, all other figures are weighted

[2] Psychiatric morbidity includes purchases of psycholeptics (ATC-codes N05) and psychoanaleptics (N06), but excludes anti-dementia drugs (N06D), and includes in-patient hospital care with a psychiatric diagnosis (ICD-10 codes F10-F69 & F99, or ICD-9 codes 291-316, if ICD-10 code was not recorded).

[3] External causes include all accidental and violent deaths (ICD-10 codes V01-X44, X46-Y89), of which suicides (X60-X84, Y87.0) were also analyzed separately.
Both underlying and contributory causes of death marked on the death certificate were used to identify alcohol-related deaths including: alcohol-induced pseudo-Cushing syndrome (E24.4), mental and behavioral disorders due to use of alcohol (F10), degeneration of nervous system due to alcohol (G31.2), epileptic seizures related to alcohol (G40.51), alcoholic polyneuropathy, myopathy, cardiomyopathy, gastritis, and liver disease (G62.1, G72.1, I42.6, K29.2, K70), alcoholic diseases of the pancreas (K85.2, K86.0), finding of alcohol in blood (R78.0), and accidental poisoning by and exposure to alcohol (X45).

[4] 3 to 2 yrs before mortality follow-up
[5] 2 to 0 yrs before mortality follow-up
[6] During mortality follow-up

Figure 1. Post-separation excess mortality (Hazard ratio, HR) by union type and gender

Figure 2. Post-separation excess mortality (Hazard ratio, HR) by time since the separation, union type and gender

Figure 3. Post-separation excess mortality (Hazard ratio, HR) by cause of death and gender

Figure 4. Post-separation excess mortality (Hazard ratio, HR) by time since the separation, cause of death and gender

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